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Radiological Dispersal Devices

Assessing the Transnational Threat

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Conclusions

- The Defense Science Board Summer Study report recognizes a "new and ominous trend—a transnational threat with a proclivity towards much greater levels of violence." The report states that transnational groups have both access to, as well as the motivation to use, weapons of mass destruction (WMD). Military and civil defense planners are increasingly concerned about possible state and non-state use of radiological dispersal devices (RDD) against U.S. forces and population centers abroad and at home.

- Practically any state or non-state actor can build and detonate RDDs as technological barriers have fallen and radiological materials have become more plentiful. However, weapons design experts contend that the physical threat from these RDDs may be overstated.

- The psychological and political effects of RDD use are not well understood and are potentially more significant than the lethality effects of such use.

- While RDDs may not be well suited as "military weapons" in the classic sense, the use of RDDs could be powerfully coercive and could trigger enormous political reactions within host countries or among allies in a coalition. These reactions could produce major strategic consequences for the military campaign.

- With protective and decontamination equipment, and training, U.S. forces should be able to withstand the physical effects of most RDDs. At home, U.S. civil defense planners—including first responders being trained under the Nunn-Lugar-Dominici initiative—must also be prepared to deal with the RDD threat.

"As the new millennium approaches, the United States faces a heightened prospect that regional aggressors, third-rate armies, terrorist cells, and even religious cults will wield disproportionate power by using—or even threatening to use—nuclear, biological, or chemical weapons against our troops in the field and our people at home."

Statement of Secretary of Defense William S. Cohen in the Preface to the Defense Science Board's 1997 Summer Task Force Final Report, October 1997.

Radiological Dispersal Devices Defined

The Department of Defense (DOD) defines an RDD as, "any device, including any weapon or equipment, other than a nuclear explosive device, specifically designed to employ radioactive material by disseminating it to cause destruction, damage, or injury by means of the radiation produced by the decay of such material." Almost any radioactive material can be used to construct an RDD, including fission products, spent fuel from nuclear reactors, and relatively low-level materials, such as medical, industrial and research waste. Weapons grade materials (i.e., highly enriched uranium or plutonium) are not needed although they could be used.

An RDD is designed to scatter radioactive debris over a wide area, thereby contaminating it and possibly causing casualties through radiation sickness, as well as denying its use to military forces or others for some period of time. According to a recent DOD report, the RDD threat is threefold: the blast and fragmentation effects from the conventional explosive, the radiation exposure from the radioactive material used, and the fear and panic that its use would spread among the target group or population. This paper examines this threat and differentiates the *physical* from the *psychological*—and therefore political—impact on a targeted population.

Background

The possibility of employing radioactive materials as a weapon was first considered during World War II. In 1941, the National Academy of Sciences proposed radiological warfare as a military application of atomic energy. In its report, the Academy's first option was the "production of violently radioactive materials . . . carried by airplanes to be scattered as bombs over enemy territory." After British physicists demonstrated the technical feasibility of nuclear explosive weapons, attention quickly turned to their development throughout the remainder of the war. In 1946, the United States conducted the Operation Crossroads nuclear weapons tests at Bikini Atoll in the Marshall Islands. The widespread contamination of ships used in these tests gave dramatic evidence of the potential of so-called radiological warfare. In 1947, the Defense Department began creating panels of experts to study the offensive and defensive aspects of what it termed "Rad War." This led to an active test program, including releases of radiation into the atmosphere in the 1940s and 1950s. The results of these early experiments showed that while RDDs were not effective as battlefield weapons, such weapons could have a significant psychological effect. Yet, for the next four decades, there was little documented interest in developing radiological weapons.

Recent concerns with an RDD threat center on both state and non-state actors. According to Western press reports in January 1991, Iraq claimed to have "secret" or "unusual" weapons that could kill tens of thousands of its foes. U.S. intelligence concluded that it was possible for Iraq to build a functioning RDD. An unclassified CIA report stated that Iraq could have obtained radioactive material from research reactors and that it could disperse this material using a conventional explosive. The report concluded that an Iraqi RDD would not be a "militarily significant" weapon because it could not cause widespread radiation sickness, even if used against unprepared and unprotected civilians in a city. However, the report also concluded that any Iraqi use of an RDD would have a substantial psychological impact.

Public Perceptions of the Threat

Since the Gulf War, RDDs have received growing attention. In particular, a number of experts on international terrorism now believe that the threat from radiological weapons is real and growing. Increasingly, observers discount the long-standing assumption that only states have the resources and

expertise to develop or acquire such weapons. According to one report, Iranian agents are known to have tried to buy nonfissile but radioactive nuclear material originating in the former Soviet Union. Moreover, sub-national and terrorist groups appear to be more likely to use them. The Aum Shinrykio sarin gas attack in Tokyo provides chilling evidence of terrorist willingness to kill large numbers of people. Indeed, the Aum Shinryko and subnational groups such as the Chechens are known to have pursued development of RDDs. In November 1995, Chechen rebels placed a 30-pound container of radioactive cesium in a Moscow park—perhaps the most recent manifestation of an adversary's willingness to use an RDD to achieve its goals.

Today, popular but sometimes inaccurate characterizations of the RDD threat focus on the danger of radiation effects from detonation, the relative ease and ready availability of radiological materials needed to construct such a device, and the readiness of potential adversaries to do so. A recent article in *Foreign Policy* notes that, "[Some] have pointed out that if a simple radiological device had been used in conjunction with the World Trade Center explosive, large areas of lower Manhattan would still be uninhabitable." This article also underscores the relative ease with which the technical know-how, materials, and equipment to make RDDs can be acquired. An article in *American Legion* points out that the danger from RDD terrorism might in fact be greater "because of the relative ease with which terrorists could obtain radioactive materials, such as an x-ray machine from a dentist's office, irradiated materials from a hospital, radioactive matter from medical laboratories or construction sites, and even linens from a cancer treatment facility." Many such claims are often overstated and could be misleading.

How the Experts See It

Notwithstanding popular perceptions, the physical effects of an RDD are dependent on several factors, but the *type* and the *amount* of radioactive material used in any device are especially critical. Current DOD studies underscore the vast difference in lethality produced by different types of radioactive materials. For instance, compare the effects of two different RDDs detonated at the Washington Monument with 100 pounds of high explosives. One device, a man-pack RDD, contains 5,000 curies of cobalt-60 (Co-60); the second device, a truck-delivered RDD, carrying 50 kilograms of bundled, not ground, one-year-old spent fuel rods.

An RDD constructed using Co-60 would produce a maximum dosage at the point of detonation of 12 rem (Roentgen Man Equivalent), resulting in no radiation related deaths. In marked contrast, the RDD made from spent reactor fuel would result in a maximum dosage at the point of detonation of 3,064 rem (six times the lethal dosage). The detonation could produce a circle of potential lethal dosage extending about a kilometer to the Washington waterfront, and, a significant amount of radioactive material would remain at the detonation site. Clearly these two RDDs would produce very different *physical* effects, the second far more lethal than the first.

National laboratory scientists generally hold that construction and use of a physically effective RDD is more difficult than popularly assumed. States and sub-national groups would have to overcome significant technical difficulties to construct and effectively deliver an RDD on target. While it is possible for a state or even a subnational group to acquire materials for an RDD, it is difficult to assemble enough highly radioactive material to produce mass casualties or to achieve wide area denial. Even if a sufficient amount of the right material can be acquired, the handling of gamma-emitting radioactive substances becomes very difficult due in part to the heat generated by large quantities of such material and the extreme exposure hazard from the intensity of the radiation. These substances require heavy shielding to protect handlers from overexposure and death. For example, the WWII Radioactive Subcommittee estimated that a bomb carrying 10,000 curies (enough to contaminate 250,000 square feet

of open fields—approximately 5.7 acres) would require 310 pounds of lead to protect those handling the device. In addition, the radioactive material would have to be ground to a dust of 5-micron-size particles and then mixed with an inactive solid material to enhance dispersion and increase the inhalation hazard. Lastly, the effects would be highly dependent on local weather conditions and terrain. These early experiments showed that cities, or build-up areas, would require "something approaching 100 times greater concentration" because structures would absorb a large fraction of the radiation. As a result of these early studies, the U.S. government concluded that RDDs were not a "militarily useful weapon."

In a February 1991 unclassified Defense Intelligence Agency report on possible Iraqi delivery of radioactive material in a SCUD warhead, the authors concluded that they could foresee no case in which such an RDD would be "militarily significant." They based this assessment on the fact that U.S. forces in the theater have equipment and training for operations in a nuclear environment, "an environment that an RDD does not even approach." Standard issue NBC gear provides excellent practical protection, especially when combined with proper radiation monitoring and exposure time limitations. Although it would be impossible to predict the precise degree of contamination without a detailed knowledge of the Iraqi radioisotope inventory, any expected dispersal pattern would produce only small areas of relatively high concentration and large areas of much weaker concentration. In no circumstances, according to this analysis, would an Iraqi RDD be expected to produce an area of immediate lethality hazard. Military forces in the area could carry out an effective cleanup by washdown and scrapedown of contaminated surfaces, thus allowing operations to resume. Permanent civilian residence in contaminated areas may be precluded, however, by residual activity that would result in dangerous dosages of accumulated radiation exposure.

The Threat: Perceptions Versus Reality

The perception that practically any state or non-state actor can build and detonate RDDs may well be coming true. However, the perception that all RDDs will have major *physical* effects is flawed. Experts contend that public commentators have overstated the ease of constructing and deploying an RDD that could cause mass casualties and deny an area's use for a lengthy period of time. Acquiring a sufficient amount of highly radioactive material (such as spent reactor fuel), constructing the device without overexposure to radiation in the process, effectively delivering the device on target, and achieving the necessary lethality to kill targeted personnel in the area are tasks beyond the capability of most non-state actors. U.S. research and experimentation over 50-plus years indicate that lethal RDDs are not easy to build. Most RDDs that non-state actors are likely to build would not be effective in producing mass casualties or denying area use. The intelligence community has indicated that this may have been the Iraqi conclusion as well, and at least one reason why Iraq did not use RDDs in the Gulf War of 1991. Of course, fear of retaliation may also have been a major factor.

On the other hand, it is true that almost any use of an RDD could have a tremendous psychological—and therefore political—impact. Thus, even crude RDDs might meet some state's or terrorist group's objective, particularly if that objective were to create panic, to disrupt (or slow down) military operations, or to bring public pressure on political leaders to change a course of action. Imagine the political consequences that could have resulted from the detonation of any RDD in the Saudi port of Ad Damman during the Desert Shield buildup in 1991 and the following news broadcast.

> *"We interrupt our regular programming with news of a radiological weapons attack against U.S. and coalition forces in Saudi Arabia only hours ago. Early reports indicate that dozens may be incapacitated by radiation overdose and hundreds or thousands of troops, as well as the local population, may be at risk."*

What would have been the reactions of U.S. and coalition military forces in the target area? The local

Saudi population? The American public and that of the other coalition countries? The U.S., Saudi and other coalition country leaders?

In addition, a partial list of military concerns would certainly include the following: How would troops in the target area have been affected—any fatalities, radiation exposure or need for evacuation? Would there be special medical or hospitalization requirements? What would have been the decontamination and cleanup requirements for personnel, facilities and equipment in the area? Could it have been done quickly with local assets, or would there have been delays in getting the proper equipment on site? Could personnel, facilities and equipment have been put back into service immediately? How long would the Desert Shield military mobilization have been delayed? Were there alternate ports that could have been used?

At the very least, RDD use will inject the uncertainty of war known as "Clausewitzian friction" into any situation and distract troops from their focus on the mission. Psychologically, such an act could demoralize troops and sap their fighting spirit and thus reduce their effectiveness in combat. Even more important, RDD use is a potentially powerful psychological tool and could trigger enormous political reactions within any one country or amongst several countries, including allies or coalition partners.

Recommendations

National leaders recognize that states and terrorist groups may acquire the wherewithal to construct and deploy weapons of mass destruction, including RDDs. The Defense Science Board's 1997 Summer Study concluded that DOD should treat transnational threats as a major Department mission and outlined a response strategy for dealing with them, which includes:

- Military tasks to protect against RDD use include assuring armed forces preparedness to conduct operations in a contaminated environment by addressing training, decontamination requirements, passive defense equipment, safety concerns and exposure guidelines.

- Civilian tasks include educating government officials and the public to promote a bette understanding of the threat, and how to respond.

- Senior military and civilian officials should include this topic on international agendas with allied and friendly countries, in order that planning, education and training in those countries can be coordinated with our own.

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